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**MODULE 19  
OCCUPATIONAL MUSCULOSKELETAL DISORDERS**

**Presenter: Capt. Mario E. Fajardo, M.D.  
Occupational Medicine Physician  
Human Factors Division (G-WKS-3)**

Disclosure: Capt. Fajardo does not have any financial arrangements or affiliations with any corporate organizations that might constitute a conflict of interest with regard to this continuing education activity.

**Goals:**

1. Learn about patients with work-related musculoskeletal complaints.
2. Know the effects occupational injuries on worker performance.
3. Understand the major neck, back and shoulder disorders.
4. Learn the association between rheumatic conditions and environmental exposures.
5. Learn about injury prevention techniques.

**Additional Material:**

At the end of the lecture additional material will be presented on the following subjects:

1. First Aid and Emergency Procedures: First Aid for Muscle Cramps; Heat Therapy; Cold Therapy; First Aid for Dislocations and Broken Bones.
2. Environmental Physiology and Medicine: Wet Bulb Globe Temperatures.
3. Pain in Sports and Rehabilitation: Rhabdomyolysis.

Note: The following material is a summary of information extracted from various sources dealing with this extensive subject matter. The presenter takes no authorship of this material. For more detailed information readers are referred to the following reference material:

1. Textbook of Clinical Occupational and Environmental Medicine,
2. Rosentock/Cullen, Chapter 14-Systemic Rheumatologic Disorders (Katz-Brissot-Liang)
3. A Practical approach to Occupational and Environmental Medicine, Second Edition, Chapter 12-Musculoskeletal Disorders (McCunney-Boswell)

## **Occupational Musculoskeletal Disorders**

The diagnosis, management and rehabilitation of musculoskeletal problems are a large component of the medical care provided in an occupational health care setting. The majority of the complaints usually involve minor aches and pains relating to simple sprains and strains. However, others may involve more severe and chronic ailments of the back, neck, and shoulder, as well as soft tissue injuries, abrasions, lacerations, repetitive muscle injuries, major trauma and crushing injuries of the extremities. Of particular interest are the musculoskeletal disorders and rheumatic complaints caused by workplace and environmental exposures that constitute a major source of morbidity and work related disability. The purpose of this lecture is to discuss some of the most prevalent musculoskeletal conditions causing total or partial work disability.

According to annual surveys by the Bureau of Labor Statistics (BLS), based on 1985 Occupational Health and Safety Administration (OSHA) 200 Log (injury data reports), occupational injuries accounted for approximately 93% of worker's compensation claims of which 45% were related to sprains and strains. Back injuries, with an incidence of 3.5/100 workers, were the most common complaint. In the U.S. musculoskeletal problems account for 30% of total work disability and approximately 40% of partial work disability. There are direct and indirect costs associated with musculoskeletal disorders which amount into the millions of dollars- lost productivity; wages; medical care; rehabilitation; training and replacement costs. Back injuries reportedly account for nearly 30% of all musculoskeletal injuries with 10% of the back injuries accounting for 80% of the total costs. Medical providers should make note that managing the small percentage of serious debilitating conditions may markedly reduce the costs associated with musculoskeletal disorders.

### **Back Injuries**

The causes of low back pain include: musculo-ligamentous injuries; vertebral compression fractures; spinal stenosis; degenerative disease; herniated discs with nerve root compression; anatomic anomalies; systemic diseases; and visceral diseases unrelated to the spine. Disabling back injuries result from pushing and pulling, exposure to industrial vibration, repetitive heavy lifting, and from a host of psychosocial factors: a history of previous back problems; smoking; job dissatisfaction; poor performance evaluations; short duration of employment; boring tasks; younger age. Obtaining an appropriate medical history of past and present back problems, performing a thorough examination, and obtaining the necessary laboratory tests and radiological and imaging procedures is essential in the evaluation of musculoskeletal complaints. In addition to the medical history, information should be obtained on the nature of the job or tasks required, the availability of power-assisted lifting equipment, the repetitive motion of the tasks and the weight of the materials being lifted, pushed

or pulled. It is also important to note any history of prior back injuries, as recurrent conditions tend to create more discomfort and take longer to resolve.

The reader should be familiar with the established lifting guidelines published by the National Institute for Occupational Safety and Health (NIOSH) as well as any State, organizational and unit policies that regulate the weight of materials to be lifted with and without assistance. Repetitive injuries from any one particular site may indicate failure to follow established safety guidelines. In our organization the cognizant Safety and Environmental Health Officer (SEHO) should be alerted to such concerns.

The physical examination should be directed to identifying any specific pathology and conditions requiring further examination or specialty consultation. Gait and motor strength as well as overall alignment of the spine should be assessed. Gait symmetry and the extent of ankle flexion and dorsiflexion may help to verify motor strength. Remember that conditions such as facet joint disease and spinal stenosis are made more comfortable by mild spinal flexion, while patients with disc herniation maintain a position of extension. The range of motion of the lumbar spine, muscle spasms and aggravating positional changes should also be recorded. Identification of nerve root compression can be done by stretching the sciatic nerve by means of the straight leg raise (SLR) or Patrick's test. This should be followed by a detailed neurological examination including touch, pressure and vibration tests along the L1-L4 dermatome distribution. The muscular strength of the hip flexors (L1-L3), knee flexors (L2, L4), ankle dorsiflexors (L4), long toe extensors (L5), and ankle evertors (L5, S1) should be evaluated and recorded as should the results of the Babinski reflex. The examiner should also pay close attention to other disorders that tend to be associated with back discomfort. An abdominal exam including rectal and pelvic procedures should be conducted whenever indicated.

Appropriate medical management should be instituted with emphasis on rest and pain relief. Bed rest of 2-3 days with the institution of ice therapy in the first 24 hours of the injury are found to be beneficial in resolving deep muscle spasms and associated pain. After the "acute phase" the application of heat to the affected area, through the use of heating pads, whirlpool or hot bath, is also found to provide relief. The use of non-steroidal anti-inflammatory agents and muscle relaxants may be indicated therapeutic alternatives in alleviating muscle spasms and providing pain relief. When symptoms subside the patient should be started on a regiment of gentle conditioning exercises. Flexion and extension exercises should be gradually implemented with the goal of regaining full use of the injured area. *William's* exercises are an appropriate stretching exercise modality that has been found beneficial for individuals recovering from an acute low back injury. Providers should assume an active role in the rehabilitation process. Providers should advise the patient on the need for adequate rest and the importance in achieving a full recovery as well as inquiring about any recurrent symptoms, response to treatment, and the progress of physical and

emotional rehabilitation. Under ideal situations patients should be evaluated on a weekly basis. If there has been enough recovery a patient can be returned to full duty or be placed in a limited duty status, as long as there are well-stipulated limitations. Conditions such as "light duty" should be avoided unless specific guidelines are provided. It may also be advisable to notify the supervisor of the member's condition and expected progress to full recovery.

*Chronic back pain* is defined by persistent pain and discomfort lasting longer than 6 weeks and unresponsive to conservative treatment. This condition would mandate further evaluation and testing to identify other causes of back pain and distinguish between inflammatory or non-inflammatory processes. The provider should also be attentive to psychological and emotional conditions that may be negatively affecting recovery, as well as looking for specific signs of underlying disorders. For example, the presence of early morning stiffness associated with inflammatory conditions such as ankylosing spondylitis; pain while walking and relieved by rest suggesting vascular claudication; pain aggravated by palpation suggesting an underlying tumor; and the steady pain of multiple myeloma.

Following is a list of common causes of back pain:

### **Mechanical**

Trauma- vertebral fractures; lumbosacral strains/sprains; sacroiliac strain  
Congenital- spondylolisthesis; spondylolysis; transitional vertebrae  
Acquired- herniated disc; spinal stenosis

### **Nonmechanical**

Rheumatic disorders- ankylosing spondylitis; psoriatic/rheumatoid arthritis  
Infections- osteomyelitis; herpes zoster; pyogenic sacroiliitis  
Tumors- osteoid osteoma; osteoblastoma; multiple myeloma; lymphomas  
Endocrine/Metabolic disorders- osteoporosis; Paget's disease; osteomalacia  
Hematologic disorders- myelofibrosis; hemoglobinopathies  
Referred pain- vertebral sarcoidosis; aortic aneurysm; retroperitoneal fibrosis

**NOTE:** above information abstracted from Robert J. McCunney, A Practical Approach to Occupational and Environmental Medicine, Second Edition. (Pg. 173)

Occupations with the highest incidence of back injuries include:

Miscellaneous workers-12.3 claims/100 workers  
Sanitation workers-11.1 claims/100 workers  
Warehouse workers- 9.3 claims/100 workers  
Miscellaneous mechanics- 5.6 claims/100 workers  
Nurses aides- 3.6 claims/100 workers

**NOTE:** above information abstracted from B.P. Klein, R.C. Jensen, and I.M. Sanderson. Assessment of worker's compensation claims for back strains/sprains. J.O.M. 26:443, 1984.

## Neck Injuries

Cervical neck injuries in the occupational health care setting refer primarily to simple strains and sprains. Most of these injuries result from sudden flexion and extension movements or twisting of the neck with shoulder extension, resulting in overstretching of the paravertebral musculature or trapezius musculature. These cervical neck strains typically referred to as “whiplash” injuries often have a delay in clinical symptoms of up to 12-24 hours. They commonly respond to conservative treatment with the use of ice, moist heat, NSAID’s and muscle relaxants. Physical therapy may be of help to those with protracted symptoms. Disc herniation in the cervical neck spine is not as typical presentation as seen in the lumbar area. However, the persistence of cervical neck pain, specially associated with radicular symptoms into the shoulder and arm or progressive neurologic findings, may necessitate an MRI to rule out cervical nerve root compression. Any evidence of nerve root compression or spinal stenosis needs to be referred for further neurological evaluation. Repetitive extension of the arms above shoulder height can lead to a condition known as occupational cervicobrachial disorder (fibromyalgia) which is very difficult to treat and may require an evaluation of the entire work station.

Neck and shoulder symptoms can also be a result of a systemic inflammatory process. For this reason a thorough investigation into the family history of the individual may prove beneficial in identifying an underlying rheumatologic disorder. Adequate attention should also be paid to the frequency and duration of extreme positions to which the head and arms are placed and the frequency that work is performed with arms above the head level. Remember that persistent discomfort may lead to a chronic pain syndrome. As previously stated, in the Ergonomics Module, it is important to determine the utilization ratio for each lift in relation to the individual’s maximal capacity. Lifting of material at near maximal capacity increases the risk of strain injuries. Working in the same position for prolonged periods of time, even if not in extreme positions, may lead to static muscle loading and a subsequent increased risk of muscle pain syndrome.

The physical evaluation should be directed to inspecting for any evidence of local swellings, erythema, or muscle atrophy. Palpation of musculo-tendinous insertions, range of motion, muscle strength and contraction as well as pain origins should be adequately evaluated. Specific test should also be performed for example: looking for *Yeargason’s sign* in a patient with shoulder pain; a *bursa test* for those with suspected shoulder bursitis; the *Roos test* for evaluation of thoracic outlet syndrome (TOS); the *Arm-Lašegue test* for brachial plexus irritation; and *foramen compression tests* for those with suspected cervical nerve root compression.

Laboratory tests for neck and shoulder pain are fairly nonspecific, though tests such as a sedimentation rate and rheumatoid factor are occasionally performed to rule out inflammatory conditions. The most important test is the appropriate

radiographs of the shoulder and cervical spine. For classification purposes the major pain syndromes of the cervical neck and shoulder are placed under the following categories:

Rotator cuff disorders  
Biceps tendonitis  
Cervical spondylosis  
Osteoarthritis of the shoulder and acromioclavicular joint  
Cervical radiculopathy  
Thoracic outlet syndrome (TOS)  
Cervicobrachial pain syndromes

### Systemic Rheumatologic Disorders

The most essential component in the evaluation of a patient with rheumatologic complaints is to perform a careful history and a thorough physical examination. The goal should be to distinguish between inflammatory and non-inflammatory conditions. Inflammatory conditions, such as rheumatoid arthritis, generally present with early morning stiffness lasting more than one hour and may be associated with systemic complaints of fatigue and malaise. On the other hand, non-inflammatory conditions, such as osteoarthritis, have less than one hour of early morning stiffness and are aggravated by prolonged physical activity.

It is also important to identify the extent of the disease and distinguish between periarticular conditions and intra-articular processes. Periarticular disorders, such as tendonitis or bursitis, are usually characterized by focal pain and tenderness with movement of the affected joint in the planes that stress the involved structure. By contrast, intra-articular conditions such as inflammatory synovitis are characterized by pain of the involved joint in all directions. Laboratory tests used to distinguish between the inflammatory and non-inflammatory processes tend to be less specific than the H & P, but nevertheless are of definite value. For example, the *erythrocyte sedimentation rate (ESR)* is usually elevated in inflammatory conditions though it may be affected by infections, age or malignant conditions; the *antinuclear antibody test (ANA)* is sensitive for systemic lupus (SLE), but is also present in 5% of the general population; *complement fixation tests* are very expensive and seldom used; *double stranded DNA tests* do tend to be more diagnostic for SLE with a 92% specificity; *radiological procedures*, in the absence of trauma, may be more suggestive, revealing bone and/or cartilage destruction; ultimately, *aspiration of synovial fluid* may be the most informative as fluid containing > 2000 white cells per cubic centimeter is considered secondary to an inflammatory reaction, while those with < 2000 are noted with osteoarthritis or other traumatic internal joint derangement.

Following is a list of musculoskeletal conditions and rheumatologic disorders known or suspected to be associated with occupational or environmental exposures:

RHEUMATIC CONDITION	EXPOSURE	ASSOCIATION
Osteoarthritis	Repetitive trauma	Suspected
Rheumatoid arthritis	Silica / agricultural work	Reported
Systemic Lupus Erythematosus	Hydrazine	Reported
Systemic sclerosis	Silica	Suspected
Scleroderma-like disorders	Vinyl chloride monomer; solvents; l-tryptophan	Known; suspected; known
Fibromyalgia	Chemical or factory work	Reported
Gout	Lead	Known
Brucellosis	Sheep; dog; cattle	Known
Lyme disease	Outdoor work	Known
Parvovirus infection	Day care	Suspected
Osteonecrosis	Diving; tunnel work	Known
Osseous fluorosis	Fluoride	Known
Muscle disorders	Halogenated hydrocarbons; firefighting	Known; reported

#### Osteoarthritis (OA)

OA is the most common form of arthritis, noted in over 80% of individuals over the age of 70. OA is characterized by alterations in the cartilage matrix that can result from many causes, though age is a significant etiological factor. The effects of repetitive forceful loading of joints in certain occupations have been suspected to damage cartilage and lead to the formation of OA. Obesity has been demonstrated to predispose individuals to development of OA in the knees suggesting the association of mechanical loading. OA has also been reported in the interphalangeal joints of piano players and winders as well as in the metacarpophalangeal joints of jackhammer operators suggesting the association with repetitive use. This association is strengthened by the lack of evidence of arthritis in similar joints by idiopathic OA.

#### Rheumatoid Arthritis (RA)

RA has a peak incidence between the fifth and fourth decades, and a prevalence of 1%, affecting women two to three times more often than men. RA is typically characterized by a symmetric polyarthritis affecting primarily the metacarpal, metatarsal phalangeal, and proximal interphalangeal joints, wrists, knees, and elbows. It may also have systemic involvement manifested by subcutaneous nodules, interstitial lung disease, pleuritis, pericarditis, and compression neuropathies such as carpal or tarsal tunnel syndromes, Sjögren's syndrome and episcleritis. RA has been implicated with exposure to silica products and work in

coalmines. The latter is part of a syndrome of nodular fibrosis of the lung and RA known as rheumatoid pneumoconiosis or Caplan's Syndrome.

#### Systemic Lupus Erythematosus (SLE)

SLE is a chronic inflammatory condition of unknown etiology. However, a lupus syndrome is caused by a number of drugs, or autoantibodies suggesting the presence of environmental or occupational etiologies. Among the medications associated with SLE are procainamide, and hydralazine. The latter contains aromatic amino and hydrazine groups, which are used in the synthesis of several products such as plastics, anticorrosives, rubber products, herbicides, pesticides, photographic supplies, textiles, dyes, and pharmaceuticals. Hydrazines occur naturally in tobacco and tobacco smoke as well as in mushrooms. Laboratory workers exposed to hydrazine have reportedly developed fatigue, a positive ANA, a photosensitivity rash, and periungual telangiectasias that resolved upon termination of the exposure. Exposure to tartrazine or FD&C yellow #5, which can be broken down into hydrazine compounds, has also been implicated in one case of a lupus-like syndrome manifesting with pruritus, photosensitivity, myalgias and arthralgias.

#### Systemic Sclerosis

Better known as Scleroderma, this systemic disorder is characterized by fibrosis, of skin, blood vessels and internal organs. It has been associated with exposure to silica following a case-control study of South African gold miners with systemic sclerosis, who were found to have a significant exposure to silica. A scleroderma-like syndrome has also been reported following exposure to vinyl chloride, which is widely found in the plastics industry, and similar scleroderma-like syndromes have been reported with exposure to epoxy resins and organic solvents. A chronic sclerodermatous skin process has also been reported among Spanish workers exposed to rapeseed oil containing aromatic amines, in what was eventually named the toxic oil syndrome (TOS). In addition, contaminants found in the development of L-tryptophan in Japan in 1989 led to an eosinophilia-myalgia syndrome further supporting the environmental exposure link. In all the aforementioned conditions symptoms resolved upon termination of the exposure.

#### Fibromyalgia

The association between fibromyalgia and environmental exposures is strictly speculative. This condition, characterized by diffuse and chronic musculoskeletal pain and discrete tender points during physical examination, has been implicated with chemical exposures as well as with episodes of cumulative trauma.

#### Gout

Gout has been widely associated with lead toxicity resulting from ingestion of lead containing materials, inhalation of lead fumes or use of illicit alcohol distilled in lead containing stills. This exquisitely tender monoarthritis with predilection to the lower extremities, particularly the first metatarsal phalangeal joint has had a recognized association with lead ingestion for over two centuries.



### Spondyloarthropathies

Spondyloarthropathies are characterized by inflammation of the spine, sacroiliac joints, peripheral joints and occasionally the eye, skin and other organs. Among these are ankylosing spondylitis, Reiter's syndrome, psoriatic arthritis, and enteropathic arthritis, which includes Crohn's and ulcerative colitis. These conditions are commonly manifested by insidious onset of low back pain, early morning stiffness that lasts more than half hour, and moderate improvement of symptoms with increasing physical activity. Unlike mechanical back pain, which has an excellent prognosis, the spondylitis can lead to progressive disability and deforming spine fusion. An aggressive physical rehabilitation program following an early and accurate diagnosis is essential in maintaining flexibility of the spine.

**Proceed to attached reading material**

FIRST AID  
WET-BULB GLOBE TEMPERATURE  
RHABDOMYOLYSIS

**Proceed to POST-TEST**